POTENTIAL USE OF CO_2 AND ENERGY WASTE FROM ETHANOL´S PLANTS FOR GREENHOUSE VEGETAL PRODUCTION

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Introduction

Brazil´s sugar and ethanol-processing industry has expanded in the last 10 years passing from 11.5 to 27.5 billons of ethanol liters between 2001 and 2009. Brazil national market growing in addition to a worldwide ethanol increasing demand constrains this sector to offer solutions to land use and sustainability issues to be able to maintain investments and its leadership.

This is an opportunity for investors interested in enterprises to link with this agro industry where greenhouse and/or aquaculture operations can be paired with power plants to take advantage of inexpensive nutrients, energy and CO_2. As the fuel ethanol industry matures, operators of individual plants are looking for resource enhancement opportunities.

One option is to co-locate new production facilities for fish, fruits, herbs, vegetables, ornamental plants and even algae's production alongside the sugar-ethanol processing plants. The waste streams from the distillery potentially could supply water, nutrients and energy to both greenhouse and aquaculture operations, and carbon dioxide from distillery process might be captured for the benefit of greenhouse plants, increasing productivity and quality.

Although greenhouse vegetable production technology is well developed and applied worldwide including developing countries, Brazil is still in its beginnings. Opportunity to reduce operation costs of high technological greenhouses is a way to increase profit margins and support investments in this sector.

Although examples mostly in North America and Europe integrating greenhouses with nuclear, natural gas, biogas or biomass driven power plants, little public information exists about the economics and likely problems of this business arrangement. Brazil, with around 400 sugar cane operating distilleries has a single opportunity to develop the largest scale food and vegetable sustainable program in the world.

Greenhouse offers high quality and add-value products all long the year. Organic production, traceability systems and food security policies can be easily integrated in the process. Commercialization is usually done directly to retail chains and supermarkets reducing losses, keeping cold chain and increasing crop shelf life.

This study presents a detailed evaluation of technical, commercial, social and environmental aspects of the integration between a hypothetical table tomato greenhouse facility and an ethanol distillery and identifies research opportunities to be pursued in the future.

Results and Conclusions

A standard alcohol industry of 2 millons tons of sugar-cane capacity producing 40 liters of ethanol per ton of sugar-cane produces 15200 tons of CO_2 per day and 886.6 GJ of low temperature thermal energy (just from vinasse cooling). Economic analysis of a tomato greenhouse facility using this above by-products shows that agronomic yields grows up to 65 kg/m^2 (Brazil national average is 6 kg/m^2, including industrial tomatoes) and production costs are 24% lower than in a conventional greenhouse. Production is possible without any pesticide and 50% less of water and fertilizer use. Project profits increase 58% up to R$ 1.2 millons/ha and ROI is lower than 1 year.

One hectare of greenhouse creates around 15 direct and permanent employments that could be a solution to the labor available from sugar-cane harvest mechanization policy. Only in São Paulo State, it is expected that 150,000 people working in sugar cane harvest will lose their jobs until 2014.

Emissions of 912 tons of CO_2/ha per year are evitated. Moreover, energy available is enough to integrate around 60 ha of greenhouses that can represent up to R$ 2.7 millons in extra revenus to the sugar cane facility.

More knowledge is needed to help innovators estimate energy availability, requirements, integration interfaces, and to point out other helpful research possibilities and educational policies. Bioethanol industry needs to establish a commercial relationship with greenhouse facility indicating social and economical local repercussions in terms of sustainable food production.

In addition, this study presents a review of actual greenhouse and aquaculture integration applications around the world. Results and potential of different applications as horticultural products, aquaculture, hydroponic green forage and algae production (for biofuel and biomass applications) are discussed.

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